CLAIMS

What is claimed is:

1. A method of performing red eye correction in an image comprising:

partially automatically defining an outline of an area in an image within which area red eye correction is to be carried out; and

carrying out red eye correction only within the area.

2. A method of performing red eye correction in an image according to claim 1 and wherein the area is a circular region.

3. A method of performing red eye correction in an image according to claim 1 and wherein said partially automatically defining an outline includes:

receiving a user input which centers the area within an eye; and

automatically defining the extent of the area based at least partially on color of locations in the area.

4. A method of performing red eye correction in an image according to claim 3 and wherein the area is a circular region.

5. A method of performing red eye correction in an image according to claim 4 and wherein the circular region is not necessarily centered in accordance with the user input.

6. A method of performing red eye correction in an image according to claim 3 and wherein said automatically defining includes re-centering the area.

7. A method of performing red eye correction in an image according to claim 3 and wherein said automatically defining includes employing a redness criterion for defining the area.

8. A method of performing red eye correction in an image according to claim 7 and wherein the redness criterion generally excludes skin tone coloration.

9. A method of performing red eye correction in an image according to claim 7 and wherein the redness criterion is expressed as follows:

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of a pixel color, respectively, taking values between 0 and 255.

10. A method of performing red eye correction in an image according to claim 7 and wherein said automatically defining includes applying a redness criterion to a periphery of the area.

11. A method of performing red eye correction in an image according to claim 10 and wherein when at least a predetermined portion of the periphery of the area does not meet the redness criteria, at least one additional area center is automatically defined.

12. A method of performing red eye correction in an image according to claim 10 and wherein the redness criterion applied to a periphery of the area varies as a function of the circumference of the area.

13. A method of performing red eye correction in an image according to claim 1 and wherein said carrying out red eye correction only within the area includes changing the values of red components of locations within the area as a function of the green components of the locations.

14. A method of performing red eye correction in an image according to claim 13 wherein the values of red components of pixels within the area are modified according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixels, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

15. A method of performing red eye correction in an image according to claim 13 and wherein the locations, the values of the red components of which are changed, are selected in accordance with a redness criteria.

16. A method of performing red eye correction in an image according to claim 15 and wherein the redness criterion generally excludes generally white light reflections.

17. A method of performing red eye correction in an image according to claim 15 and wherein the redness criterion is expressed as follows:

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of a pixel color, respectively, taking values between 0 and 255.

18. A system for performing red eye correction in an image comprising:

a red eye area processor partially automatically defining an outline of an area in an image within which area red eye correction is to be carried out; and

a red eye correction processor carrying out red eye correction only within the area.

19. A system for performing red eye correction in an image according to claim 18 and wherein the area is a circular region.

20. A system for performing red eye correction in an image according to claim 18 and wherein said red eye area processor includes:

a user interface receiving a user input which centers the area within an eye; and

an area adjustment processor automatically defining the extent of the area based at least partially on color of locations in the area.

21. A system for performing red eye correction in an image according to claim 20 and wherein the area is a circular region.

22. A system for performing red eye correction in an image according to claim 21 and wherein the circular region is not necessarily centered in accordance with the user

input.

23. A system for performing red eye correction in an image according to claim 20 and wherein said area adjustment processor re-centers the area.

24. A system for performing red eye correction in an image according to claim 20 and wherein said area adjustment processor employs a redness criterion for defining the area.

25. A system for performing red eye correction in an image according to claim 24 and wherein the redness criterion generally excludes skin tone coloration.

26. A system for performing red eye correction in an image according to claim 24 and wherein the redness criterion is expressed as follows:

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of a pixel color, respectively, taking values between 0 and 255.

27. A system for performing red eye correction in an image according to claim 24 and wherein said area adjustment processor applies a redness criterion to a periphery of the area.

28. A system for performing red eye correction in an image according to claim 27 and wherein when at least a predetermined portion of the periphery of the area does not meet the redness criteria, at least one additional area center is automatically defined.

29. A system for performing red eye correction in an image according to claim 27 and wherein the redness criterion applied to a periphery of the area varies as a function of the circumference of the area.

30. A system for performing red eye correction in an image according to claim 17 and wherein said red eye correction processor changes the values of red components of locations within the area as a function of the green components of the locations.

31. A system for performing red eye correction in an image according to claim 30 wherein the values of red components of pixels within the area are modified according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

32. A system for performing red eye correction in an image according to claim 30 and wherein the locations, the values of the red components of which are changed, are selected in accordance with a redness criteria.

33. A system for performing red eye correction in an image according to claim 32 and wherein the redness criterion generally excludes generally white light reflections.

34. A system for performing red eye correction in an image according to claim 32 and wherein the redness criterion is expressed as follows:

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of a pixel color, respectively.

35. A method of performing red eye correction in an image comprising:

storing a high resolution image on a server computer;

transmitting a low resolution image derived from the high resolution image, from the server computer to a client computer;

displaying the low resolution image on a display device connected to the client computer;

receiving from a user an indication of a selected location within the displayed low resolution image;

partially automatically defining an outline of an area in the low resolution image

within which area red eye correction is to be carried out, by the client computer, based on the user's selected location;

carrying out red eye correction on the low resolution image only within the area, by the client computer; and

transmitting parameters of the area from the client computer to the server computer.

36. A method of performing red eye correction according to claim 35 further comprising performing red eye correction on the high resolution image by the server computer, using the parameters of the area received from the client computer.

37. A method of performing red eye correction according to claim 35 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

38. A method of performing red eye correction according to claim 35 wherein parameters of the area are expressed in resolution-independent form.

39. A method of performing red eye correction according to claim 35 wherein the low resolution image is also stored on the server computer.

40. A method of performing red eye correction according to claim 35 wherein the low resolution image is derived from the high resolution image by the server computer.

41. A method of performing red eye correction according to claim 35 wherein said partially automatically defining determines the area so as to tightly cover pixels that exhibit red eye.

42. A method of performing red eye correction according to claim 41 wherein a pixel is identified as exhibiting red eye if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

43. A method of performing red eye correction according to claim 41 wherein said carrying out red eye correction comprises modifying red color values of pixels identified as being reddish, based on green color values of such pixels.

44. A method of performing red eye correction according to claim 43 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

45. A method of performing red eye correction according to claim 43 wherein a pixel is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively.

46. A method of performing red eye correction according to claim 43 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

47. A method of performing red eye correction in an image comprising:

displaying an image on a display device;

receiving from a user an indication of a selected location within the displayed image;

partially automatically defining an outline of an area in the image within which area red eye correction is to be carried out, by the client computer, based on the user's selected location;

carrying out red eye correction on the image only within the area; and

transmitting parameters of the area to a server computer.

48. A method of performing red eye correction according to claim 47 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

49. A method of performing red eye correction according to claim 47 wherein parameters of the area are expressed in resolution-independent form.

50. A method of performing red eye correction according to claim 47 wherein said partially automatically defining determines the area so as to tightly cover pixels that exhibit red eye.

51. A method of performing red eye correction according to claim 50 wherein a pixel is identified as exhibiting red eye if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

52. A method of performing red eye correction according to claim 50 wherein said carrying out red eye correction comprises modifying red color values of pixels identified as being reddish, based on green color values of such pixels.

53. A method of performing red eye correction according to claim 52 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

54. A method of performing red eye correction according to claim 52 wherein a pixel is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel

color, respectively.

55. A method of performing red eye correction according to claim 52 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

56. A method of performing red eye correction in an image comprising:

storing a high resolution image;

transmitting a low resolution image derived from the high resolution image, to a client computer; and

receiving from the client computer parameters of an area in the low resolution image within which area red eye correction is to be carried out.

57. A method of performing red eye correction according to claim 56 further comprising carrying out red eye correction on the high resolution image, using the parameters of the area received from the client computer.

58. A method of performing red eye correction according to claim 57 wherein said carrying out red eye correction comprises modifying red color values of pixels identified as being reddish, based on green color values of such pixels.

59. A method of performing red eye correction according to claim 58 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12 ,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

60. A method of performing red eye correction according to claim 58 wherein a pixel

is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively.

61. A method of performing red eye correction according to claim 58 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

62. A method of performing red eye correction according to claim 56 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

63. A method of performing red eye correction according to claim 56 wherein parameters of the area are expressed in resolution-independent form.

64. A method of performing red eye correction according to claim 56 wherein the low resolution image is also stored on the server computer.

65. A method of performing red eye correction according to claim 56 wherein the low resolution image is derived from the high resolution image by the server computer.

66. A system for performing red eye correction in an image comprising:

a server memory storing a high resolution image on a server computer;

a server transmitter transmitting a low resolution image derived from the high resolution image, from the server computer to a client computer;

a client display device connected to the client computer displaying the low resolution image;

a client user interface on the client computer receiving from a user an indication of a selected location within the displayed low resolution image;

a client red eye area processor partially automatically defining an outline of an area in the low resolution image within which area red eye correction is to be carried out, by the client computer, based on the user's selected location;

a client red eye correction processor carrying out red eye correction on the low resolution image only within the area, by the client computer; and

a client transmitter transmitting parameters of the area from the client computer to the server computer.

67. A system for performing red eye correction according to claim 66 further comprising a server red eye correction processor performing red eye correction on the high resolution image by the server computer, using the parameters of the area received from the client computer.

68. A system for performing red eye correction according to claim 66 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

69. A system for performing red eye correction according to claim 66 wherein parameters of the area are expressed in resolution-independent form.

70. A system for performing red eye correction according to claim 66 wherein the low resolution image is also stored in said server memory.

71. A system for performing red eye correction according to claim 66 wherein the low resolution image is derived from the high resolution image by the server computer.

72. A system for performing red eye correction according to claim 66 wherein said red eye area processor determines the area so as to tightly cover pixels that exhibit red eye.

73. A system for performing red eye correction according to claim 72 wherein a pixel is identified as exhibiting red eye if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

74. A system for performing red eye correction according to claim 66 wherein said red eye correction processor modifies red color values of pixels identified as being reddish, based on green color values of such pixels.

75. A system for performing red eye correction according to claim 74 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

76. A system for performing red eye correction according to claim 74 wherein a pixel is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively.

77. A system for performing red eye correction according to claim 74 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

78. A system for performing red eye correction in an image comprising:

a display device displaying an image;

a receiver receiving from a user an indication of a selected location within the displayed image;

a red eye area processor partially automatically defining an outline of an area in the image within which area red eye correction is to be carried out based on the user's selected location;

a red eye correction processor carrying out red eye correction on the image only within the area; and

a transmitter transmitting parameters of the area to a server computer.

79. A system for performing red eye correction according to claim 78 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

80. A system for performing red eye correction according to claim 78 wherein parameters of the area are expressed in resolution-independent form.

81. A system for performing red eye correction according to claim 78 wherein said red eye area processor determines the area so as to tightly cover pixels that exhibit red eye.

82. A system for performing red eye correction according to claim 81 wherein a pixel is identified as exhibiting red eye if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

83. A system for performing red eye correction according to claim 78 wherein said red eye correction processor modifies red color values of pixels identified as being reddish, based on green color values of such pixels.

84. A system for performing red eye correction according to claim 83 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

85. A system for performing red eye correction according to claim 83 wherein a pixel is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively.

86. A system for performing red eye correction according to claim 83 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G \ .$$

87. A system for performing red eye correction in an image comprising:

a memory storing a high resolution image;

a transmitter transmitting a low resolution image derived from the high resolution image, to a client computer; and

a receiver receiving from the client computer parameters of an area in the low resolution image within which area red eye correction is to be carried out.

88. A system for performing red eye correction according to claim 87 further comprising a red eye correction processor carrying out red eye correction on the high resolution image, using the parameters of the area received from the client computer.

89. A system for performing red eye correction according to claim 88 wherein said red eye correction processor modifies red color values of pixels identified as being reddish, based on green color values of such pixels.

90. A system for performing red eye correction according to claim 89 wherein a pixel is identified as being reddish if

$$2R > 3G + 12, \qquad R > B + 12,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively, taking values between 0 and 255.

91. A system for performing red eye correction according to claim 89 wherein a pixel is identified as being reddish if

$$R > G, \qquad R > B,$$

where R, G and B are the values of red, green and blue color components of the pixel color, respectively.

92. A system for performing red eye correction according to claim 89 wherein said modifying modifies a red color value of a pixel identified as being reddish according to

$$R' = \begin{cases} R - \Delta e^{-2\frac{(u^2+v^2)^2}{d^4}}, & \text{if } \Delta > 0 \\ R, & \text{if } \Delta \le 0 \end{cases},$$

where R and G are pre-corrected values of red and green color components of the pixel, respectively, and where R' is the corrected value of the red color component, and where Δ is given by

$$\Delta = R - \frac{5}{4}G .$$

93. A system for performing red eye correction according to claim 87 wherein the area is a circle and the parameters of the area include the center and diameter of the circle.

94. A system for performing red eye correction according to claim 87 wherein parameters of the area are expressed in resolution-independent form.

95. A system for performing red eye correction according to claim 87 wherein the low resolution image is also stored in said memory.

96. A system for performing red eye correction according to claim 87 wherein the low resolution image is derived from the high resolution image.